50X1-HUM

CLASSIFICATION CONFIDENTIAL CONFIDENTIAL

CENTRAL INTELLIGENCE AGENCY

INFORMATION FROM

FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT

CD NO.

COUNTRY	USSR	DATE OF INFORMATION	1949
SUBJECT	Nuclear physics	DATE DIST.	9 Dec 1949
HOW PUBLISHED	Thrice-monthly periodical		
WHERE PUBLISHED	Moscow	NO. OF PAGES	2
DATE PUBLISHED	11 Sep 1949	SUPPLEMENT TO REPORT NO.	
LANGUAGE	Russian		

THIS IS UNEVALUATED INFORMATION

SOURCE Doklady Akademii Nauk SSSR, Vol LXVIII, No 2, 1949.

PROBLEM OF A PHYSICAL METHOD OF SEPARATING NUCLEAR ISOMERS

A. S. Karamyan

[A Digest]

A previous article by the author, "The Mechanism of the Physical Method for Separating Nuclear Isomers," [redacted] pointed out that radiobromine atoms freed from C_2H_5Br molecules by thermal neutron bombardment of ethyl bromide are resynthesized into organic molecules.

50X1-HUM

The metastable Br^{80*} atoms bound in molecules, on being discharged by internal electron conversion, are transformed into Br^{80}. They fly out of the molecules simultaneously and thus increase the liquid's content of free radioactive Br^{80} atoms in the ground state.

The bromine isomers Br^{80} and Br^{80*} are separated as a result of this secondary flight of Br^{80} isomers from the molecules in their formation from Br^{80*} isomers.

It was further shown that the number of free radioactive atoms, due to the re-entry of a part of them into the organic molecules, decreases exponentially with a half-period of the order of 20 hours.

However, if we compare the theoretical and experimental relative numbers of bound atoms formed during bombardment, we find the experimental figure approximately [illegible] times the calculated figure. This discrepancy may be explained either by an acceleration of the synthesis of free radiobromine atoms into organic molecules during bombardment due to the high speeds of the recoil atoms or by the fact that a part of the radiobromine atoms does not leave the ethyl bromide molecules during the discharge of the compound nuclei.

To determine which of these possible mechanisms actually takes place, it was necessary to set up an experiment in which re-entry of the free radioatoms into the molecule would be made more difficult during bombardment.

CLASSIFICATION CONFIDENTIAL CONFIDENTIAL

STATE	X	NAVY	X	NSRB	DISTRIBUTION
ARMY	X	AIR	X	FBI	AEC X

50X1-HUM

If a part of the radioactive atoms does not leave the molecules during discharge of the compound nuclei, then this experiment should not reveal a substantial decrease in the number of radiobromine atoms bound in the molecules. But if the first of the mechanisms indicated occurs, then such an experiment should yield a sharp decrease in the number of bound atoms formed during bombardment.

The experiment was carried out in the following way: 60 cubic centimeters of ethyl bromide (C_2H_5Br) were mixed with 300 cubic centimeters of tetraethyl lead $[(C_2H_5)_4Pb]$ and this mixture was bombarded with slow neutrons.

The addition of tetraethyl lead decreased several times the probability of encounters between a bromine atom flying out and an ethyl bromide molecule and thereby decreased the probability of synthesis of a radiobromine atom into C_2H_5Br or $C_2H_4Br_2$ molecules.

For comparison, pure ethyl bromide was bombarded under the same experimental conditions. After bombardment, 30 cubic centimeters of ethyl bromide were distilled from the mixture by utilizing differences in boiling points.

To obtain complete uniformity, the pure ethyl bromide bombarded was also subjected to distillation until 30 cubic centimeters of ethyl bromide were obtained in a distilled fraction. Free radiobromine atoms were separated from each of the 30-centimeter ethyl bromide samples obtained in this way. The separation was carried out by an electric field onto silver plates.

The radioactive decay curves of both samples were obtained. One curve shows the intensity of beta radiation of the sample prepared from ethyl bromide bombarded in a mixture with tetraethyl lead as a function of the time after bombardment ended; the other curve shows the same function for the sample separated from ethyl bromide which was bombarded in the pure form.

An analysis of the curves (broken down into components corresponding to the three periods which bromine has) shows that, within the limits of error in the experiment, the activity of free Br^{80*} atoms (t equals 4.4 hours) and Br^{82} atoms (t equals 34 hours) is identical in both samples. The activity of free Br^{80} (t equals 18 minutes) atoms, however, is approximately five times higher in the sample obtained from ethyl bombarded in the pure form.

The free radioactive atoms were separated 3½ hours after the end of bombardment; therefore, all activity disintegrating with a half-life of 18 minutes is of secondary importance and thus determines the number of Br^{80*} atoms (t equals 4.4 hours) bound in molecules.

The experiments conducted show that the number of radioactive atoms bound in ethyl bromide bombarded in a mixture with tetraethyl lead was only one fifth the number of atoms bound in ethyl bromide bombarded in the pure form.

Thus we conclude that during bombardment all bromine atoms that capture a neutron fly out of the molecules and then are again resynthesized into organic molecules.

The speed of this synthesis during bombardment is considerably greater than the speed of synthesis after bombardment. This is explained, apparently, by the high recoil energy obtained by the radiobromine atoms during discharge of the compound nuclei.

50X1-HUM

- E N D -